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The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN SECTIONS OF INDIAN CREEK, PLUMAS COUNTY, 1990

by

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INTRODUCTION

In 1976, the Department of Water Resources (DWR) initiated an instream flow program to identify streams that would benefit from flow enhancement to assess instream values required to enhance these streams. The Northern District of DWR selected Indian Creek below Antelope Reservoir (Figure 1) as one of the streams to study under this program. Initial flow studies by DWR indicated that flow augmentation could double trout habitat in the first 16 km of Indian Creek below the dam and increase habitat by 25 percent in lower reaches (DWR, 1979). As a result of this study, DWR and the Department of Fish and Game (DFG) decided to reoperate Antelope Reservoir to increase flow releases from 0.1 cms to 0.6 cms year-round on a trial basis. These flows would not impair recreation at Antelope Reservoir.

Sampling of salmonids was begun in Indian Creek at six different stations in 1977. Sampling continued through 1982 on a yearly basis to provide baseline data for salmonid biomasses (Brown 1978, Brown and Haines 1979, Haines and Brown 1980, Villa and Brown 1981, Villa 1982, Bumpass et. al. 1987a). Fish were not sampled in 1983, 1984, or 1985. Sampling resumed in 1986 and continued in 1987, 1988, and 1989 (Bumpass et. al. 1987b, Bumpass and Smith 1989, Bumpass and Brown 1989).

A separate report will discuss the results of 25 years of trout sampling in Indian Creek. Data presented in this report will be discussed in the 25 year summary.

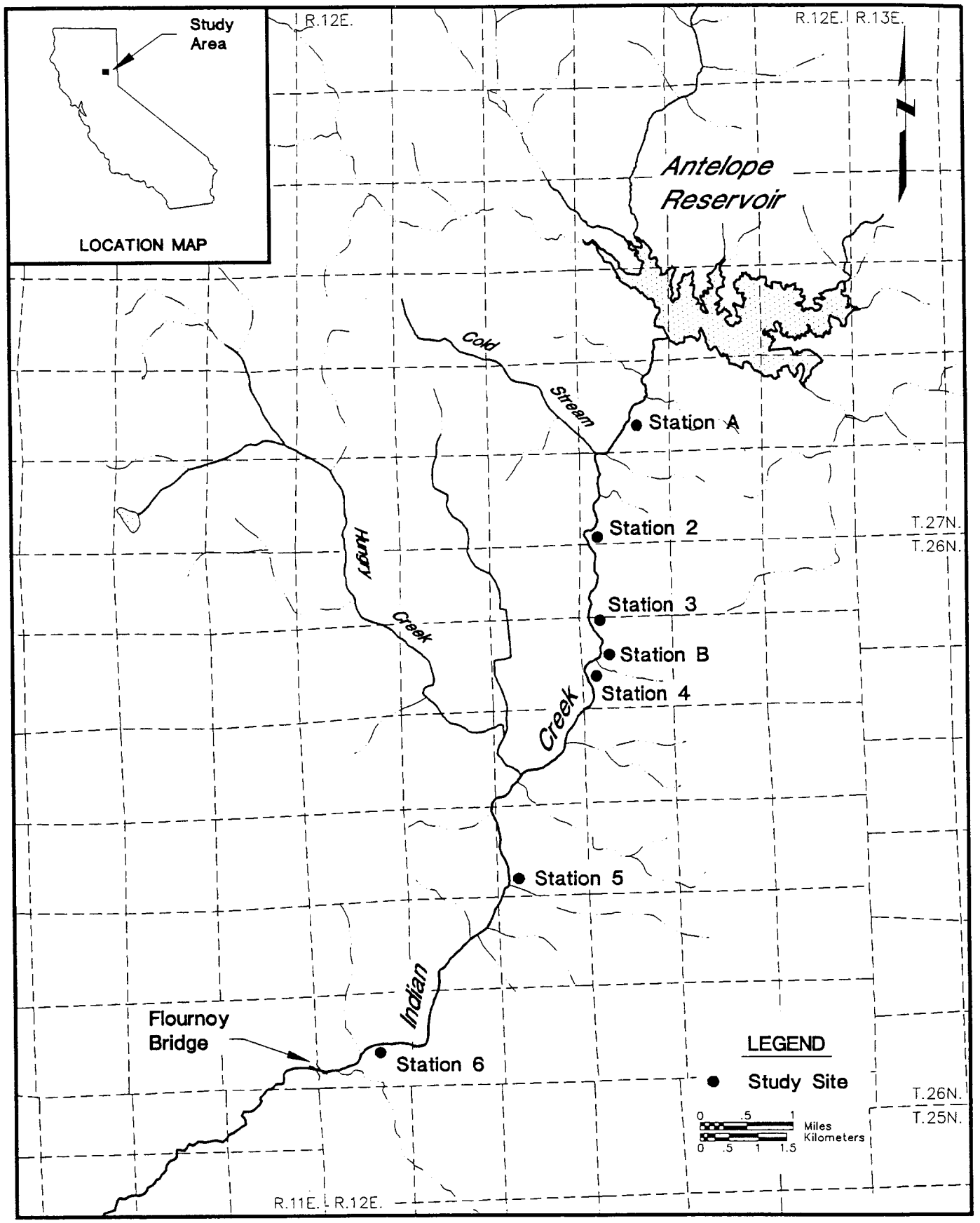

Figure 1. Stations sampled to determine biomass of fishes in Indian Creek, Plumas County, September 1990.

METHODS

Standing stocks of fishes were estimated at seven stations in Indian Creek (Figure 1), Plumas County, in September, 1990. Stations were intentionally selected to be near stations sampled in previous DFG studies (Appendix 1). Markers had previously been placed in trees along the stream to identify station boundaries. Stations varied in length from 26.2 to 73.0 m; the length, average width, and average depth of each station was measured. Fish were captured with a battery-powered backpack electroshocker in stream sections blocked by seines. Captured fish were removed from the net-enclosed section on each pass. Standing stock estimates were developed using the two-count method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by DeLury (1951).

The weights of brown trout (Salmo trutta) and rainbow trout (Oncorhynchus mykiss) were determined by displacement. Weights were measured for all trout caught. Fork length was measured to the nearest millimeter for each trout, Sacramento squawfish (Ptychocheilus grandis), and Sacramento sucker (Catostomus occidentalis).

Scale samples were taken only from brown trout and rainbow trout over 100 mm in length. Scales were mounted dry between microscope slides, and their images were projected on a NCR microfiche reader at a magnification of 42x. Scale measurements for the calculation of growth were recorded to the nearest millimeter along the anterior radius of the anterior-posterior axis of the scale.

Geometric mean functional regressions were used to describe the body-scale and length-weight relationships (Ricker 1975). Estimation of true mean growth rate was calculated using methods of Ricker (op. cit.).

Distribution of all fish caught is listed according to location. Standing crops of brown trout and rainbow trout were calculated for individual stations where the species of interest were caught. Age and growth were calculated for the population. Mean individual growth was calculated only for brown trout and rainbow trout. Length-weight relationships, coefficient of condition, and 95 percent confidence intervals were calculated for both brown trout and rainbow trout.

RESULTS

Distribution

Brown trout were caught at stations A through 6. Rainbow trout were caught at stations B, 5 and 6 (Table 1).

TABLE 1. Distribution of Fishes in Sections of Indian Creek, Plumas County, 1990.

	Station Number						
	A	2	3	B	4	5	6
Distance below Antelope Dam (km)	1.3	3.9	5.3	6.6	6.8	12.3	21.0
Brown trout	X	X	X	X	X	X	X
Rainbow trout				X		X	X

Standing Crop

Brown trout were the most common game fish caught in Indian Creek. Biomass averaged 4.2 g/m^2 at seven stations. Biomass for brown trout large enough for fishermen to catch and keep (127 mm FL and larger) averaged 3.5 g/m^2 (Table 2). Rainbow trout biomass averaged 2.2 g/m^2, while the biomass for catchables averaged 2.0 g/m^2 (Table 3).

TABLE 2. Estimate of Brown Trout Standing Crop in Indian Creek, Plumas County, 1990.

Distance Below Antelope Dam (km)	Population Estimate	95 Percent Confidence Interval	Biomass (g/m^2)	Estimate of Catchable Trout (≥127 mm FL)	Biomass of Catchable Trout (g/m^2)
1.3	21	18-31	7.3	14	7.2
3.9	49	47-54	4.6	17	3.9
5.3	130	107-158	9.7	31	8.0
6.6	8	8-10	1.7	5	1.6
6.8	161	136-185	4.8	11	2.4
12.3	43	42-47	1.6	4	1.5
21.0	2	2-2	0.1	0	0

TABLE 3. Estimates of Rainbow Trout Standing Crop in Indian Creek, Plumas County, 1990.

Distance Below Antelope Dam (km)	Population Estimate	95% Confidence Interval	Biomass (g/m^2)	Estimate of Catchable Trout (≥127 mm FL)	Biomass of Catchable Trout (g/m^2)
6.6	43	38-54	1.5	8	1.0
12.3	9	9-10	1.1	4	0.9
21.0	6	6-7	4.1	6	4.1

Age and Growth

The formula L = 60.7 + 3.9 S describes the relationship between the fork length (L) and enlarged scale radius (S) of 75 brown trout caught in Indian Creek. The coefficient of correlation (r^2) is 0.66. The formula was L = 52.1 + 4.0 S for 19 rainbow trout caught, while the value for r^2 is 0.70.

Both the population instantaneous growth rate and the mean individual instantaneous growth rate were faster in age 1+ brown trout than in age 2+ trout. Population growth was faster than mean individual growth in both 1+ and 2+ fish (Table 4).

Population growth was faster than mean individual growth in age 1+ rainbow trout (Table 5).

TABLE 4. Growth Rates for Brown Trout Caught in Indian Creek, Plumas County, 1990.

	Population Growth			Mean Individual Growth		
Age Interval	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	80-164	0.718	2.154	85-164	0.657	1.971
2-3	164-265	0.480	1.776	190-265	0.333	1.232

TABLE 5. Growth Rates for Rainbow Trout Caught in Indian Creek, Plumas County, 1990.

	Population Growth			Mean Individual Growth		
Age Interval	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	70-159	0.820	2.870	72-159	0.792	2.772

Age 1+ brown trout averaged 148 mm in fork length; 2+ fish averaged 213 mm and 3+ trout averaged 301 mm (Table 6). Age 1+ and 2+ rainbow trout measured 128 mm and 187 mm, respectively (Table 7).

TABLE 6. Calculated Fork Length of Brown Trout from Indian Creek, Plumas County, 1990.

Age	No. of Fish	Length at Capture (mm)	Calculated Lengths at Successive Annuli 1	2	3
1	8	148	80	-	-
2	47	213	85	164	-
3	18	301	107	190	265
Number of back-calculations			73	65	18
Weighted means (mm)			90	174	265
Increments (mm)			90	84	91

TABLE 7. Calculated Fork Length of Rainbow Trout from Indian Creek, Plumas County, 1990.

Age	No. of Fish	Length at Capture (mm)	Calculated Lengths at a Successive Annuli 1	2
1	12	128	70	-
2	4	187	72	159
Number of back-calculations			16	4
Weighted means (mm)			71	159
Increments (mm)			71	88

Length and Weight

Age group 0+ brown trout represented 83 percent of the catch. Ages 1+ and 2+ fish represented 2 percent and 14 percent, respectively, while 3+ fish made up 1 percent (Figure 2). Age group 0+ rainbow trout represented 66 percent of the catch. Ages 1+ and 2+ trout made up 23 percent and 11 percent, respectively (Figure 3). (Appendices 2 and 4).

The relationship between length (L) and weight (W) of brown trout is:

$$\text{Log}_{10}\ W = -4.6 + 2.9\ \text{Log}_{10}\ L$$

$$r^2 = 0.99$$

N = 371 (Figure 4 and Appendix 3)

The same relationship for rainbow trout is:

$$\text{Log}_{10}\ W = -4.7 + 2.9\ \text{Log}_{10}\ L$$

$$r^2 = 0.99$$

N = 53 (Figure 5 and Appendix 5)

Coefficient of Condition

We calculated the coefficient of condition and 95 percent confidence limits for a total of 371 brown trout and 53 rainbow trout (Table 8). There is no significant difference between the coefficient of condition for any age group of brown trout or rainbow trout we tested.

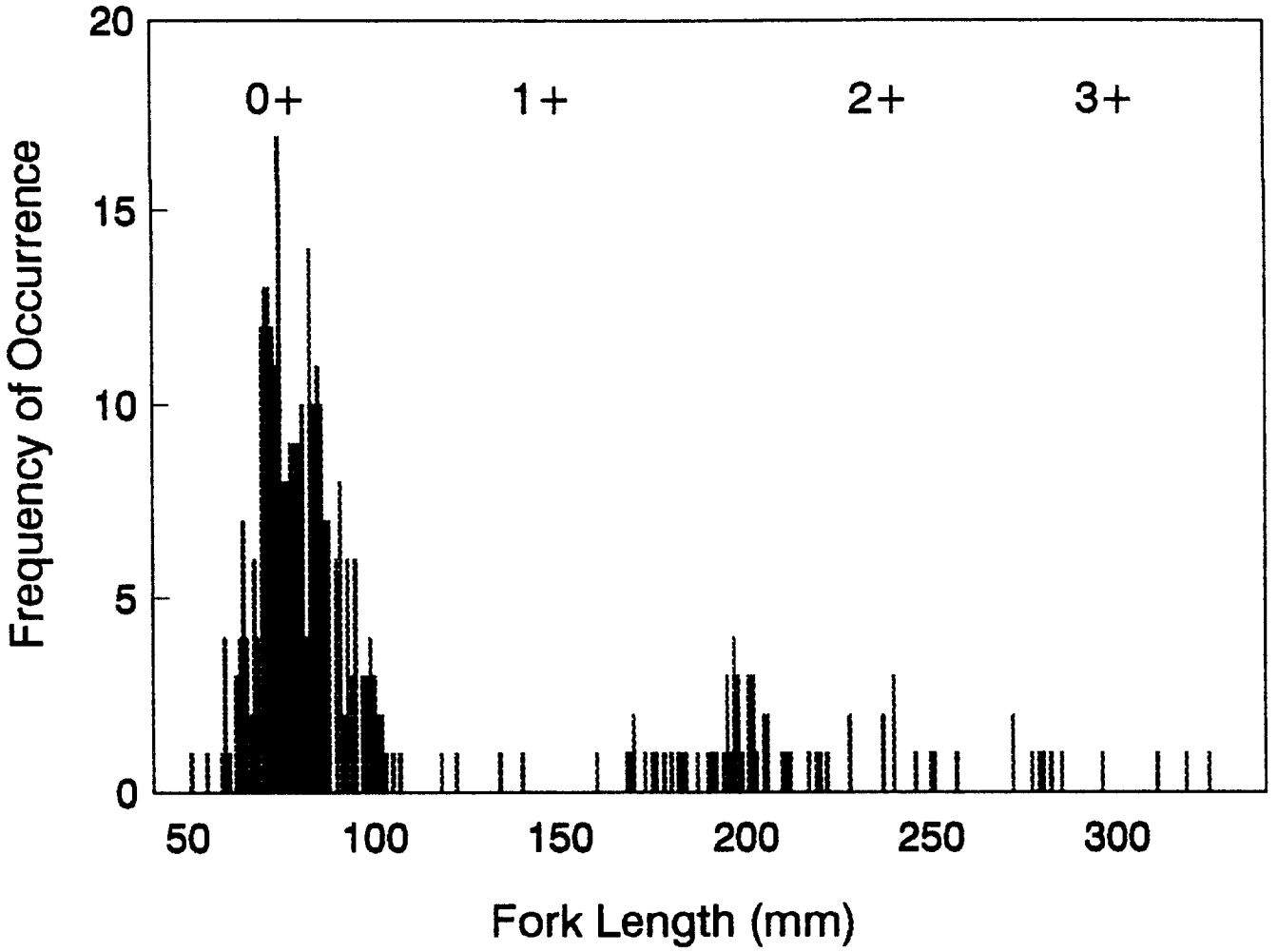

FIGURE 2. Length, observed frequency, and age of brown trout caught in Indian Creek, Plumas County, 1990.

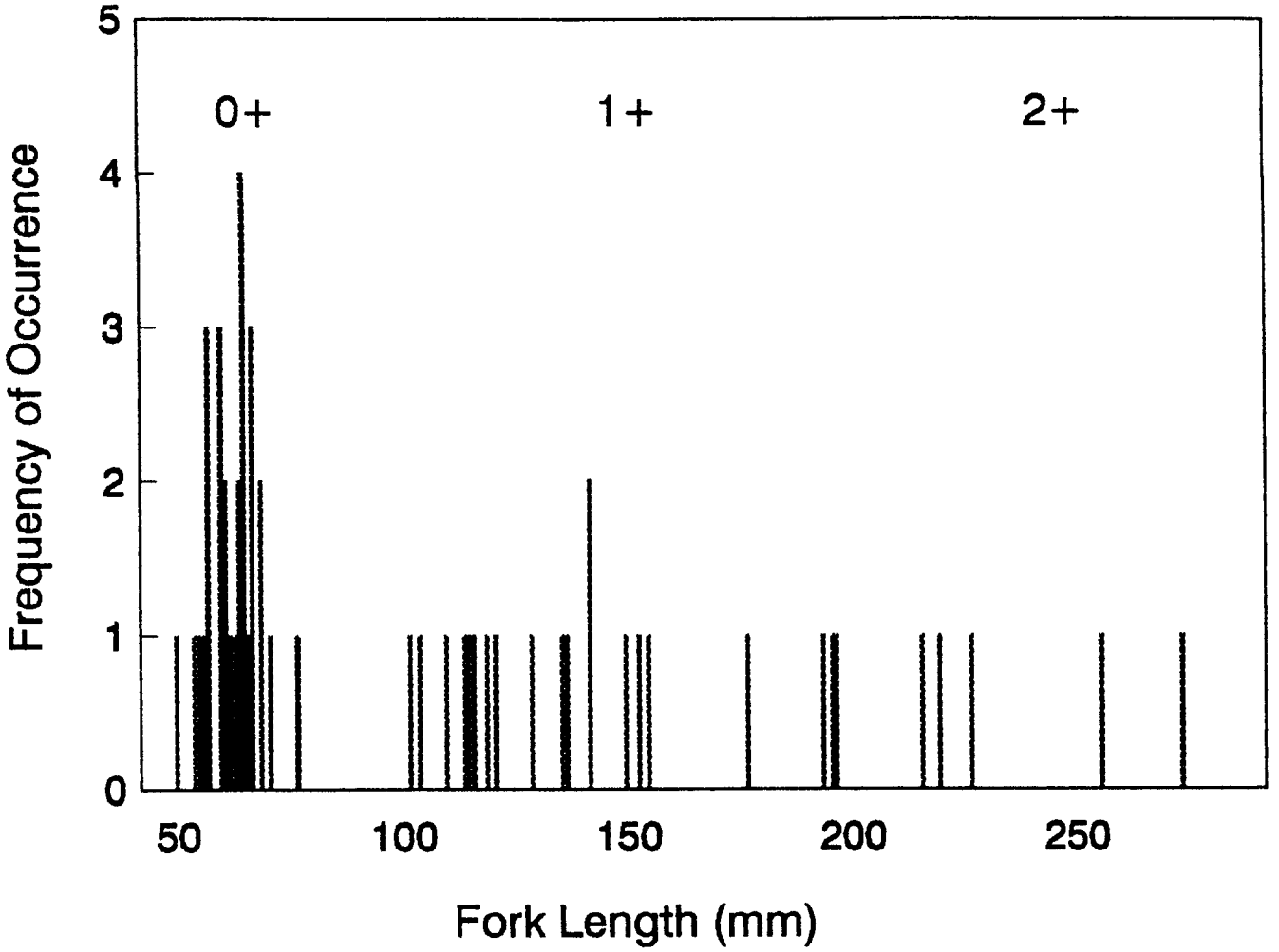

FIGURE 3. Length, observed frequency, and age of rainbow trout caught in Indian Creek, Plumas County, 1990.

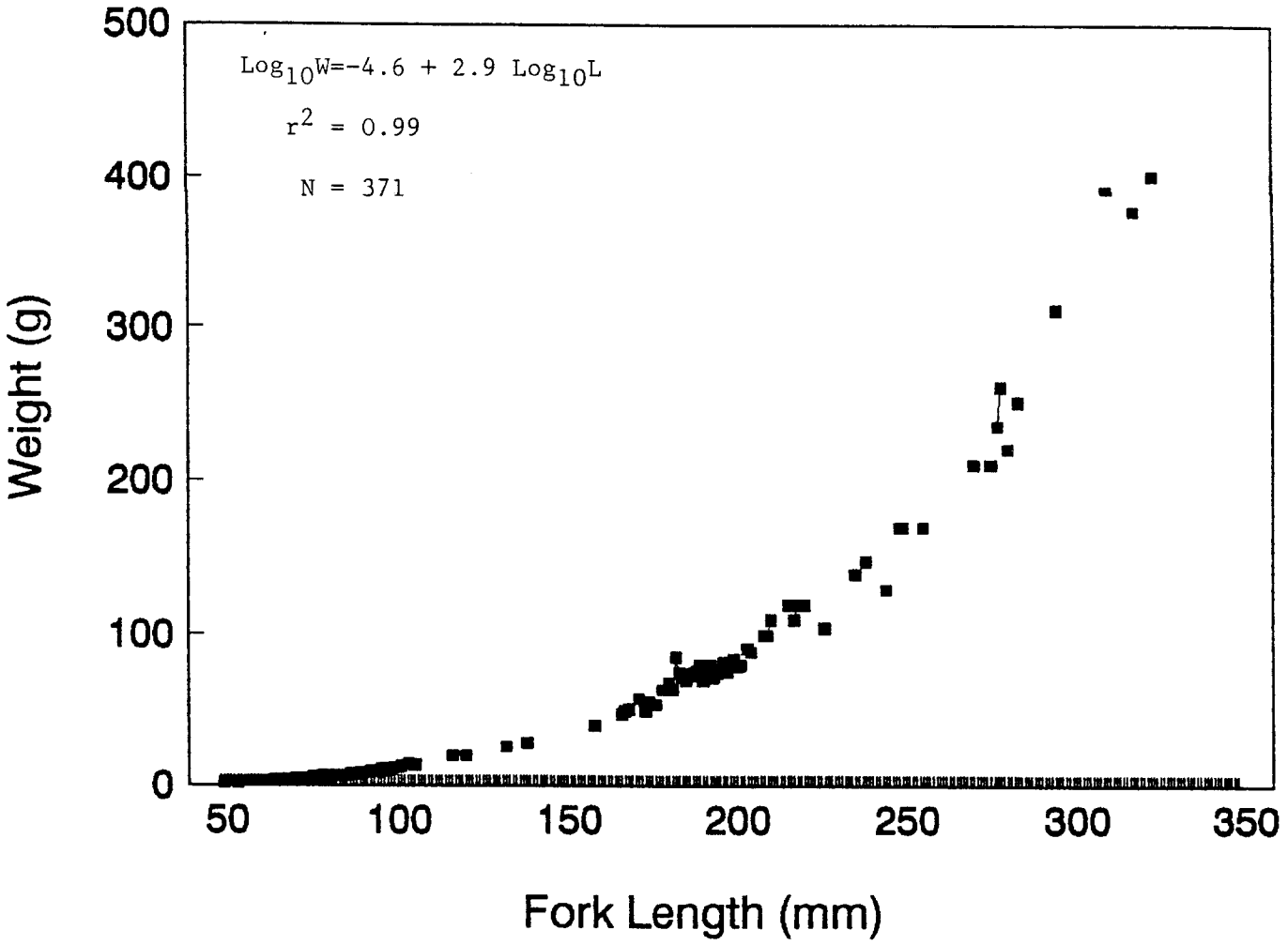

FIGURE 4. The relationship between length and weight of brown trout caught in sections of Indian Creek, Plumas County, 1990.

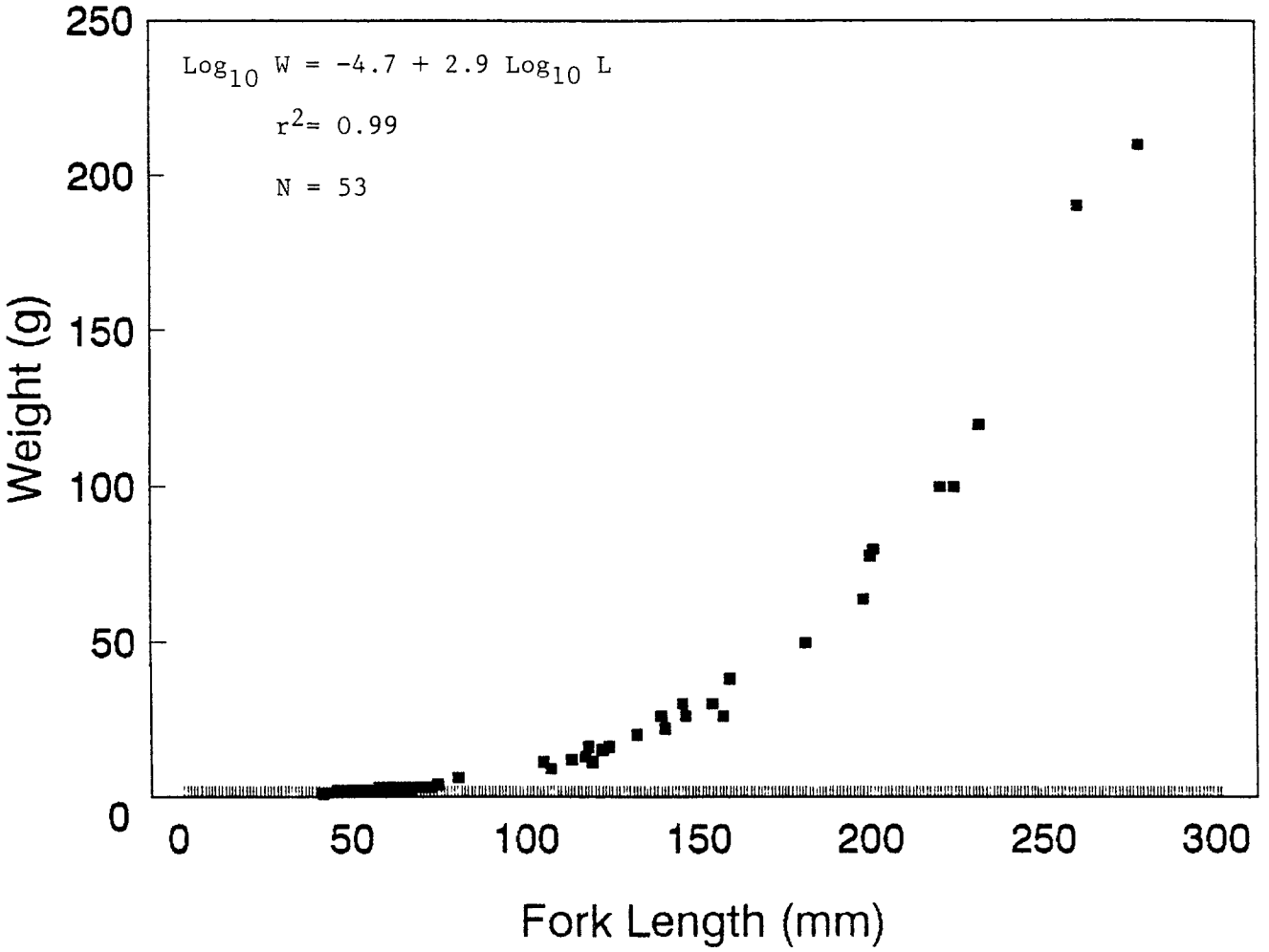

FIGURE 5. The relationship between length and weight of rainbow trout caught in sections of Indian Creek, Plumas County, 1990.

TABLE 8. Condition of Brown Trout and Rainbow Trout in Indian Creek, Plumas County, 1990

Age Group	Number of Fish	Coefficient of Condition	95% Confidence Interval
Brown trout			
0+	295	1.1699	0.8717-1.4681
1+	9	1.0641	0.9372-1.1910
2+	49	1.0641	0.8831-1.2451
3+	18	1.1219	0.7389-1.5049
Combined	371	1.1490	0.8494-1.4486
Rainbow trout			
0+	34	1.1897	0.7792-1.6002
1+	14	0.9904	0.7561-1.2247
2+	5	1.0326	0.8915-1.1737
Combined	53	1.1263	0.7308-1.5219

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APPENDIX 1

FISH POPULATION STATIONS ON INDIAN CREEK,
PLUMAS COUNTY, SEPTEMBER 1990 AT 0.56 CMS

Station	Distance below Antelope Dam (km)	UTM	Length(m)	Surface area(m^2)	Volume(m^3)
A	1.3	035 493	69.5	485.1	155.2
2	3.9	025 467	38.6	304.9	91.5
3	5.3	024 453	73.0	372.3	92.3
B	6.6	010 423	37.0	307.1	95.0
4	6.8	024 445	59.0	448.4	89.7
5	12.3	009 409	41.9	352.0	84.5
6	21.0	982 377	26.2	146.2	35.1

APPENDIX 2

LENGTH AND NUMBER OF BROWN TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1990

Fork Length (mm)	Number	Fork Length (mm)	Number
51	1	176	1
55	1	178	1
59	1	180	1
60	4	182	1
61	1	183	1
63	3	184	1
64	4	187	1
65	7	190	1
66	4	191	1
67	2	192	1
68	6	194	1
69	4	195	3
70	12	196	1
71	13	197	4
72	14	198	3
73	12	199	1
74	11	201	3
75	17	202	3
76	8	203	1
77	8	205	2
78	9	206	2
79	9	210	1
80	9	211	1
81	10	212	1
82	4	217	1
83	14	219	1
84	10	220	1
85	11	222	1
86	10	228	2
87	7	237	2
88	7	240	3
90	6	246	1
91	7	250	1
92	2	251	1
93	6	257	1
94	3	272	2
95	6	277	1
97	3	278	1
98	3	279	2
99	4	280	1
100	3	282	1
101	2	285	4
102	2	287	1
103	1	289	1
105	1	293	1
107	1	295	1
118	1	296	1
122	1	298	1
134	1	300	1
140	1	305	1
160	1	306	1
168	1	311	1
169	1	319	1
170	2	320	1
173	1	325	1
175	1		

APPENDIX 3

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1990

Fork Length (mm)	Weight (g)
51	2
55	2
59	3
60	2,3,3,4
61	3
63	3,3,4
64	2,3,3,3
65	2,3,3,3,3,3,4
66	3,3,4,5
67	4,4
68	3,3,3,4,4,4
69	3,3,4,4
70	3,3,4,4,4,4,4,4,4,4,4,4,5
71	3,4,4,4,4,4,4,5,5,5,5,5,5
72	4,4,4,4,4,4,5,5,5,5,5,5,5,5
73	4,4,4,4,4,4,5,5,5,5,5,6
74	4,4,4,4,5,5,5,5,5,6,6
75	4,4,4,4,4,5,5,5,5,5,5,5,5, 4,4,4,4
76	4,5,5,5,5,6,6,6
77	5,5,5,5,6,6,6,6
78	5,5,5,5,6,6,6,6,6
79	5,5,5,5,5,6,6,6,6
80	6,6,6,6,6,7,7,7,8
81	5,5,5,6,6,6,6,6,7,7
82	6,6,6,7
83	6,6,6,6,7,7,7,7,7,7,7,7,8,8
84	6,6,6,6,7,7,7,7,7,8
85	6,7,7,7,7,7,7,7,7,8,8
86	6,7,7,7,7,7,8,8,8,9
87	7,7,7,7,7,7,7
88	7,7,7,8,8,9,9
90	7,7,8,8,9,9
91	8,8,8,8,8,9,10
92	8,10
93	8,9,9,9,10,10
94	9,10,10
95	9,10,10,10,10,11
97	10,11,11
98	10,10,10
99	10,11,11,11
100	10,11,13
101	12,12
102	12,12
103	13
105	15
107	14
118	20
122	20
134	26
140	28
160	40
168	48
169	50
170	50,52
173	58
175	50
176	56
178	54
180	64
182	68
183	64
184	85
187	70
190	76
191	80
192	70
194	80
195	68,74,86
196	90
197	70,78,80,80
198	80,82,84
199	76
201	80,82,90
202	70,80,86
203	80
205	90,92
206	88,90
210	100
211	100
212	110
217	120
219	110
220	120
222	120
228	100,110
237	130,150
240	130,150,165
246	130
250	170
251	170
257	170
272	200,220
277	210
278	220
279	235,250
280	260
282	220
285	254,250,250,280
287	285
289	298
293	300
295	310
296	310
298	260
300	350
305	360
306	320
311	390
319	375
320	400
325	400

APPENDIX 4

LENGTH AND NUMBER OF RAINBOW TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1990

Fork Length (mm)	Frequency
46	1
50	1
51	1
52	1
53	3
56	3
57	2
58	1
59	1
60	2
61	4
62	1
63	3
65	2
67	1
73	1
98	1
100	1
106	1
110	1
111	1
112	1
115	1
117	1
125	1
132	1
133	1
138	2
146	1
149	1
151	1
173	1
190	1
192	1
193	1
212	1
216	1
223	1
252	1
270	1

APPENDIX 5

LENGTH AND WEIGHT OF RAINBOW TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1990

Fork Length (mm)	Weight (g)
46	1
50	2
51	2
52	2
53	1.5,2,2
56	2,2,2
57	2,3
58	2
59	2
60	2,3
61	2,2.5,3,3
62	2
63	3,3,3
65	3,3
67	4
73	6
98	11
100	9
106	12
110	13
111	16
112	11
115	15
117	16
125	20
132	26
133	22
138	26,30
146	30
149	26
151	38
173	50
190	64
192	78
193	80
212	100
216	100
223	120
252	190
270	210